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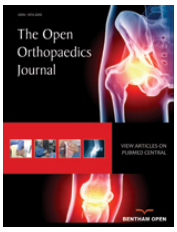

REVIEW ARTICLE

A Scoping Review of Joint Protection Programs for People with Hand Arthritis

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Abstract:

Background:

Joint Protection (JP) can be enhanced by incorporating recent evidence and innovations in collaboration with people with hand arthritis to be salient, useful and effectively implemented.

Objective:

The purpose of this study is to map the current research on JP principles and guide future research on JP programs for the management of hand arthritis.

Methods:

A search was performed in 4 databases (PubMed, EMBASE, Google SCHOLAR, CINHAL) from January 1990 to February 2017. A Grey literature was also conducted through the Google web search engine. A combination of search terms was used such as hand osteoarthritis, rheumatoid arthritis, joint protection and/or self-management strategies.

Results:

Our search found 8,788 citations in which 231 articles were deemed relevant and after duplication 111 articles were retrieved for a full-text review. In total, 40 articles were eligible for data extraction. The majority of the articles were randomized controlled trials (RCTs), systematic reviews and overviews of reviews that investigated joint protection for hand arthritis. Joint protection was tested mostly in rheumatoid arthritis (RA) population and to a lesser extent on hand osteoarthritis and was provided mainly by an occupational therapist.

Conclusion:

This review synthesized and critically examined the scope of JP for the management of hand arthritis and found that RCTs, systematic reviews and overviews of reviews constituted two-thirds of the current body of literature. Furthermore, it identified a lack of clarity regarding the specific elements of joint protection programs used in clinical studies.

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1. INTRODUCTION

Hand osteoarthritis (h-OA) is one the most common type of osteoarthritis (OA), and it is a leading cause of disability in the elderly population around the world [1]. Asymptomatic h-OA is characterized by nodes and deformities in the finger joints. Symptomatic h-OA is usually associated with pain, stiffness and limited functional ability [2]. Reports from "The Framingham study" in 2002 showed that the prevalence of symptoms in h-OA was higher than the symptoms in the knee [1]. Management of h-OA typically includes pharmacological (medications) and/or non-pharmacological interventions such as joint protection programs, assistive devices, and hand exercises. Currently, there is no cure for h-OA and individuals with symptomatic h-OA need strategies and approaches on how to maintain their active daily living and functioning.

Joint protection programs were primarily developed for people with Rheumatoid Arthritis (RA) and had been reported to be beneficial [3]. Joint protection includes self-management strategies to alleviate pain, reduce inflammation and reduce the risk of deformities [4]. Also, joint protection has been developed as an approach to improve the performance of daily tasks by enhancing the control perceptions and improve the psychological status of the patient [5]. Joint protection is considered a multimodal intervention that aims to alter working methods by using proper body mechanics and by using assistive devices. It is often integrated with stretching and hand exercises [54]. Individuals with RA can play an essential role in the management of their disease progression, but this requires their involvement. The American College of Rheumatology in 2012 guidelines [6] suggested the use of joint protection for the management of h-OA however, no definite recommendations have been made so far. The European League Against Rheumatism (EULAR) evidence-based recommendations [3] reported that the joint protection programs is a well-established approach for the management of RA but whether this method can be generalized to h-OA remains unclear. A scoping review of joint protection programs will be a narrative synthesis that aims to map the basic principles of joint protection and identify the primary sources of the current scientific evidence.

2. PURPOSE OF THE STUDY

The purpose of this scoping review is to gather, synthesize and critically examine the scope of joint protection principles for the management of h-OA and guide future research on joint protection programs for the future management of h-OA. The following questions were generated:

1. What are the main sources of scientific evidence of the current joint protection programs?
2. What are the main outcome measures that are used for joint protection?
3. What are the current approaches of the joint protection programs?
4. What is available in "Grey Literature" for joint protection programs?

3. METHODS

This study followed the steps of reporting guidelines by Arksey and O' Malley's [7]. The steps were as follows: identifying the research question [1], identifying relevant studies [2], study selection [1], charting the data [4] and synthesizing, summarizing and reporting the results [7].

3.1. Study Identification

The first author (PB) performed the literature search in 4 databases (PubMed, EMBASE, Google SCHOLAR and CINHAL) from January 1990 to February 2017. A combination of search terms was used such as hand osteoarthritis or/and rheumatoid arthritis, joint protection and/or hand exercises and/or self-management strategies. A Grey literature was also conducted through the Google web search engine. The grey literature was investigated through google manual searches in the first 10 pages of results. Also, relevant articles from the scientific databases and the grey literature were selected from the title and entered into a word database file.

3.2. Study Selection

The title and the abstract from all the articles and the grey literature were independently screened by 2 investigators (PB) and (GN) and discrepancies were resolved by discussion with a 3rd investigator (JM). We included all articles and handbooks (grey literature) that contained information about joint protection programs for people with hand

osteoarthritis and/or rheumatoid arthritis. Studies, where the primary language was not in English, were excluded from the review process. Also, studies and grey literature that focused exclusively on assistive devices or orthotic devices or hand exercises were excluded from our review. Articles with the same data presentation were prioritized as the ones that have the most details, and the others were eliminated. A flow diagram of the search results and selection process is shown in Fig. (**1**).

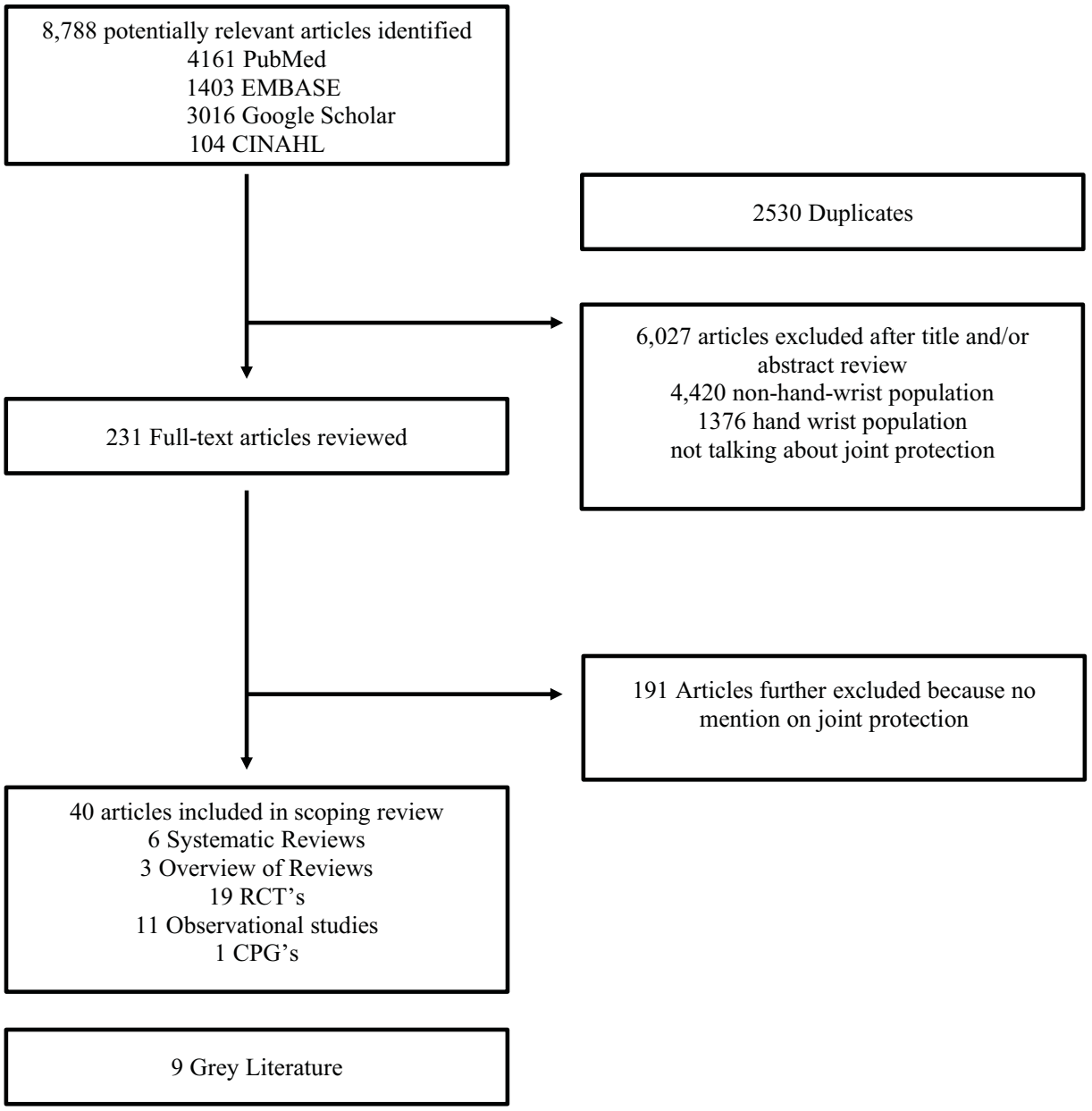

Fig. (1). Selection of articles and grey literature for scoping review.

3.3. Data Charting

Data were extracted from the first author (PB) from the included studies. Data information included Author(s) name or source, year of publication, type of research, study population, age, outcome measures, joint protection approaches, and by whom it was provided, and if authors made any recommendations.

3.4. Analyzing, Synthesizing and Reporting the Results

Description of the study design, the population that was examined and by whom the joint protection was delivered. The reported summarized findings are presented in a summary (Table **1**). To answer our research questions, we categorized each type of study by level of evidence. Current joint protection approaches/principles and outcome measures are listed and reported in separate Tables **2** and **3**. Grey literature was reported in a different category (Tables **4** and **6**).

Table 1. Characteristics of the included studies.

Author(s) or Source	Year of Publication	Type of Study	Study Population	Joint Protection provided by
1. Siegel(26)	2017	Systematic Review	Rheumatoid Arthritis	N/A
2. McGee(44)	2017	Cross-sectional Study	Osteoarthritis	N/A
3. Carandang(55)	2016	Systematic Review	Rheumatoid Arthritis	N/A
4. Williams(56)	2015	RCT	Rheumatoid Arthritis	N/A
5. Hammond(57)	2015	Book (chapter)	Osteoarthritis	Occupational Therapist (OT), Physical Therapist (PT)
6. Oppong(58)	2015	RCT	Osteoarthritis	N/A
7. Dziedzic(53)	2015	RCT	Osteoarthritis	N/A
8. Spaans(28)	2015	Systematic Review	Osteoarthritis	Occupational Therapist (OT)
9. Ekelman(59)	2014	Overview of Reviews	Rheumatoid Arthritis	N/A
10. Dilek(19)	2013	RCT	Osteoarthritis	Occupational Therapist (OT)
11. Niedermann(20)	2012	RCT	Rheumatoid Arthritis	researcher
12. Beasley(60)	2012	Literature Review	Both	Occupational Therapist (OT)
13. Swann(36)	2011	Literature Review	Rheumatoid Arthritis	N/A
14. Niedermann(21)	2011	RCT	Rheumatoid Arthritis	N/A
15. Niedermann(61)	2010	Mixed methods study	Rheumatoid Arthritis	Occupational Therapist (OT)
16. Valdes(62)	2010	Systematic Review	Osteoarthritis	Occupational Therapist (OT)
17. Boustedt(63)	2010	Cohort Study	Osteoarthritis	N/A
18. Vliet Vlieland(33)	2009	Overview of Reviews	Rheumatoid Arthritis	Occupational Therapist (OT)
19. Hammond(51)	2008	RCT	Rheumatoid Arthritis	Occupational Therapist (OT)
20. Steultjens(30)	2008	Systematic Review	Rheumatoid Arthritis	Occupational Therapist (OT)
21. Masiero(23)	2007	RCT	Rheumatoid Arthritis	Occupational Therapist (OT)
22. Quintrec(16)	2007	RCT	Rheumatoid Arthritis	N/A
23. Christie(64)	2007	Overview of Reviews	Rheumatoid Arthritis	an interdisciplinary team (PT, OT, MD)
24. O'Brien(65)	2006	RCT	Rheumatoid Arthritis	N/A
25. Gossec(66)	2006	Clinical practice guidelines	Rheumatoid Arthritis	N/A
26. Steultjens (31)	2005	Systematic Review	Rheumatoid Arthritis	N/A
27. Veitiene(67)	2005	Survey	Both	N/A
28. Hammond(68)	2004	Literature Review	Rheumatoid Arthritis	N/A
29. Hammond(52)	2004	RCT	Rheumatoid Arthritis	N/A
30. Stamm(69)	2002	RCT	Osteoarthritis	N/A
31. Hammond(46)	2002	RCT	Rheumatoid Arthritis	Occupational Therapist (OT)
32. Hammond(11)	2001	RCT	Rheumatoid Arthritis	Occupational Therapist (OT)
33. Hammond(12)	1999	RCT	Rheumatoid Arthritis	Occupational Therapist (OT)
34. Hammond(70)	1999	Cohort Study	Rheumatoid Arthritis	N/A
35. Scholten(17)	1999	RCT	Rheumatoid Arthritis	N/A
36. Hammond(4)	1998	Survey	Rheumatoid Arthritis	N/A
37. Lindroth(13)	1997	RCT	Rheumatoid Arthritis	Occupational Therapist (OT), Physical Therapist (PT), Medical Staff (Nurse, doctor)
38. Lindroth(15)	1995	RCT	Rheumatoid Arthritis	N/A
39. Hammond(71)	1994	Pilot study	Rheumatoid Arthritis	N/A
40. Neuberger(50)	1993	RCT	Rheumatoid Arthritis	Occupational Therapist (OT)

Table 2. Study outcome measures that were reported.

Author(s)	Year	Outcome Measures
Siegel	2017	Joint protection behavior, function, pain, fatigue, self-efficacy, stiffness
McGee	2017	Grip Strength, Numeric Rating Scale (NRS), Arthritis Impact Measurement Scale 2 (AIMS2)
Carandang	2016	Joint protection behavior
Williams	2015	The Arthritis Self-Efficacy Scale (ASES), Grip Strength, Finger Range of Motion (ROM), Michigan Hand Questionnaire (MHQ), Hand Dexterity, European Quality of Life 5 (EQ-5D-3L), Wrist Range of Motion (ROM), Short-Form 12 (SF-12), Self-Efficacy, Global Change, Pain (MHQ), Adherence
Oppong	2015	European Quality of Life 5 (EQ-5D-3L), Osteoarthritis Research Society International (OARSI)
Dziedzic	2013	The Arthritis Self-Efficacy Scale (ASES), Grip Strength, Short- Form 12 (v2), AUSCAN, Numeric Rating Scale (NRS), Pinch Strength, Global Change, functional performance using the grip ability test (GAT)
Ekelman	2014	morning stiffness, pain, and functional capacity
Dilek	2013	Visual Analog Scale (VAS), Grip Strength, AUSCAN, Pinch Strength, Dreiser Functional Index, Wrist Range of Motion (ROM)
Niedermann	2012	The Arthritis Self-Efficacy Scale (ASES), Joint Protection behavior Assessment (JPBA), Health Anxiety and Depression Scale (HADS), Visual Analog Scale (VAS), Disease Activity Score (DAS 28), Grip Strength, EUROHIS-QUOL 8, JP-specific self-efficacy (JP-SES)
Niedermann	2011	The Arthritis Self-Efficacy Scale (ASES), Joint Protection behaviour Assessment (JPBA), Health Anxiety and Depression Scale (HADS), Visual Analog Scale (VAS), Disease Activity Score (DAS 28), Grip Strength, Hand Joint Alignment and Motion Scale (H-JAM), Health Assessment Questionnaire (HAQ), Sense of Coherence (SOC), EUROHIS-QUOL 8, Wrist Range of Motion (ROM), JP self-efficacy scale (J-SES),
Niedermann	2010	Disease Activity Score (DAS 28), Health Assessment Questionnaire (HAQ)
Boustedt	2010	Visual Analog Scale (VAS), Grip Strength, Pinch Strength, DASH
Quintric	2009	Health Assessment Questionnaire (HAQ)
Hammond	2008	The Arthritis Self-Efficacy Scale (ASES), the Visual Analog Scale (VAS), Health Assessment Questionnaire (HAQ), RA Self-efficacy (RASE) Scale, the Arthritis Stages of Change Questionnaire
Steultjens	2008	Pain, fatigue, functional abilities (including dexterity), physical independence, quality of life (including well-being and depression). knowledge about disease management, compliance, self-efficacy, range of motion, muscle strength
Masiero	2007	Visual Analog Scale (VAS), Health Assessment Questionnaire (HAQ), Arthritis Impact Measurement Scale 2 (AIMS2)
Christie	2007	Pain, function, and patient global assessment.
O'Brien	2006	Grip Strength, Hand Dexterity, Pinch Strength, Arthritis Impact Measurement Scale 2 (AIMS2), finger flexion ROM goniometry, Jebsen–Taylor hand function test
Hammond	2004	The Arthritis Self-Efficacy Scale (ASES), Joint Protection behavior Assessment (JPBA), Visual Analog Scale (VAS), Grip Strength, Rheumatoid Arthritis Disease Activity Index (RADAI), Wrist Range of Motion (ROM), Arthritis Impact Measurement Scale 2 (AIMS2), EULAR 28,
Stamm	2002	Visual Analog Scale (VAS), Grip Strength, Health Assessment Questionnaire (HAQ)
Hammond	2002	The Arthritis Self-Efficacy Scale (ASES), Joint Protection behavior Assessment (JPBA), Visual Analog Scale (VAS), Grip Strength, Health Assessment Questionnaire (HAQ), Self-Efficacy, Patient Knowledge Questionnaire, Rheumatology Attitudes Index (RAI)
Hammond	2001	Joint Protection behavior Assessment (JPBA), Visual Analog Scale (VAS), Grip Strength, Hand Joint Alignment and Motion Scale (H-JAM), Arthritis Impact Measurement Scale 2 (AIMS2), Self-Efficacy, EULAR 28 tender, Rheumatoid Attitudes Index (RAI)
Hammond	1999	The Arthritis Self-Efficacy Scale (ASES), Joint Protection behaviour Assessment (JPBA), Visual Analog Scale (VAS), Grip Strength, Hand Joint Alignment and Motion Scale (H-JAM), Health Assessment Questionnaire (HAQ), Arthritis Helplessness Index (AHI), Hand Joint Count, Joint Protection Knowledge Assessment (JPKA)
Hammond	1999	Joint Protection behavior Assessment (JPBA), Visual Analog Scale (VAS), Health Assessment Questionnaire (HAQ), Hand Joint Count, knowledge questionnaire
Scholten	1999	Stanford Health Assessment Questionnaire, German version of the Freiburg Questionnaire of Coping with Illness (FQCI), Beck Depression Inventory (BDI),
Hammond	1998	Health Assessment Questionnaire (HAQ)
Lindroth	1997	Visual Analog Scale (VAS), Arthritis Helplessness Index (AHI), Stanford Health Assessment Questionnaire
Lindroth	1995	Health Assessment Questionnaire (HAQ), Pain (VAS
Hammond	1994	Joint Protection behavior Assessment (JPBA)
Neuberger	1993	Visual Analog Scale (VAS), Center for Epidemiologic Studies Depression Scale (CES-D)

Table 3. Joint protection Principles/Approaches that were reported from the included studies.

Author(s)	Year	Joint Protection Principles
Siegel	2017	the session was ranging from 45 minutes to 120 minutes
McGee	2017	In a standing position, participants maintained standardized glenohumeral and elbow joint positions as well as hand placements to control for the distal kinetic variance that might result from non-standardized posturing.
Carandang	2016	Uses guidelines that include techniques such as balancing rest and activity and the use of large joints Stresses education about disease, symptoms, and prognosis (especially effects of synovitis); incorporates family and routine
Williams	2015	The Number of sessions dependent on clinical need up to a maximum of three sessions or 1.5 hours in total. Rheumatoid Arthritis, a booklet providing general information about the disease and its management; Looking After Your Joints When You Have Arthritis, describing various self-management techniques and JP advice; and Keep Moving – How a few Simple Exercises can Make You Feel Better About Yourself and Your Arthritis, a booklet providing general exercise information along with suggestions as to specific exercises that could be performed for all parts of the body
Hammond	2015	• Joint protection: Respect pain; distribute the load over several joints; use the strongest, largest joint to perform an activity; avoid working in positions of potential deformity; reduce effort by using assistive devices and avoiding lifting and carrying, and avoid prolonged periods of working in the same position. • Energy conservation: Pace by balancing rest and work and alternate heavy and light activities; use work simplification; use correct working positions and postures.
Dziedzic	2013	▶ distributing the weight of what you lift over several joints (*e.g.*, spread the load over two hands) ▶ avoiding putting strain on the thumb and repetitive thumb movements ▶ avoiding prolonged grips in one position ▶ using as large a grip as possible ▶ reducing the effort needed to do a task (*e.g.*, use labor-saving gadgets; avoid lifting heavy objects, and reduce the weight of what you lift) ▶ energy conservation (activity pacing and planning)
Ekelman	2014	Training includes movement training to promote daily manual work by reducing pain and joint strain, preventing deformity, and maintaining functional capacity; self-exercise programs for hands; and provision of information on assistive devices, methods to adapt the environment, and the value, use, and handling of orthoses.
Niedermann	2012	Demonstrations and supervised practice of hand JP methods, mostly in kitchen activities, and demonstration of appropriate assistive devices. The interventions consisted of five 45-minute sessions, four over a three-week period and one booster session two months later
Beasley	2012	Respect pain, balance rest and activity, perform the exercise in a pain-free range, avoid positions of deformity, reduce the effort and force, use larger/stronger joints
Swann	2011	The main techniques for joint protection are to (Arthritis Research UK, 2010): Use larger, stronger joints, Spread the load over several joints, Reduce effort by using labor-saving gadgets, Avoid gripping things tightly, Avoid positions that push joints towards
Boustedt	2010	Joint protection consists of information about hand anatomy, osteoarthritis, and theoretical and practical information about pain and how to cope with it [6]. To introduce alternate working methods to reduce difficulties of daily activities the women tried grip assistive devices and elastic thumb splints during the day both at the clinic and at home.
Hammond	2008	joint protection (including 45min demonstration and practice), managing fatigue, aims of splinting, managing stress and relaxation (45 min practice)
Masiero	2007	Principles of JP and energy conservation, including a demonstration of various hand-JP techniques, plus a homework task to identify problem activities and find solutions based on the imparted principles, work difficulties, *etc*.
O'Brien	2006	basic principles of joint protection, energy conservation, 'top tips' relating to personal and household activities,
Hammond	2004	Both education programmes consisted of four 2-hour weekly meetings.
Stamm	2002	joint protection instruction: the need for balance between movement and resting a joint; dividing stress between as many joints as possible; using larger and stronger joints; using each joint in its most stable plane to reduce pressure on the joint; avoiding staying in one position, and avoiding vibrations for the finger joints.
Hammond	2001	principles of joint protection and energy conservation; demonstration of some hand-joint protection methods; and a homework task to identify problem activities and to find solutions using the principles taught.
Hammond	1999	Arthritis and Rheumatism council leaflets
Hammond	1998	Altering ways of moving hands during daily activities to reduce joint strain
Hammond	1994	Four JP principles were assessed: (1) distributing the load over several joints; (2) using each joint in its most stable position; (3) reducing effort by use of aids and avoiding lifting; and (4) avoiding positions of possible joint deformity
Neuberger	1993	Joint Protection Principles

4. RESULTS

Our search found 8,788 citations. After duplication 231 articles were deemed relevant from the title and abstract. Review of abstracts identified 111 articles and were assessed for a full-text review. In total, 40 articles were eligible for inclusion in the scoping review (Fig. **1**). The most common reason that studies were excluded was that either they did not test joint protection on hand or they talked about patient education in general and not for joint protection. Approximately 72% of the included articles reported Rheumatoid Arthritis (RA) as a patient population and only 20% reported patients with hand Osteoarthritis (h-OA). A small portion of studies (8%) included both populations for joint protection programs. The average age of the included population was ranging from 48.95 to 67.2 years old. In terms of

sex, more than 75% of the included sample size were females across the studies.

5. STUDY DESCRIPTION

The majority of the articles which consisted of 70% of the included articles were [19]: randomized controlled trials [8 - 25], [6] systematic reviews [26 - 31] and [3] overviews of reviews [32 - 34]. The rest of the studies were a critical review of the literature [35 - 37], cohort studies [38, 39], surveys [40, 41], mixed methods studies [42], pilot [43] and cross-sectional studies [44]. The characteristics of the included studies are summarized in Table **1**.

Table 4. Special Considerations for Joint protection principles for the hand from Physiopedia (Grey Literature online material on joint protection).

1. AVOID TIGHT GRASP	• Use a relaxed grip. • Enlarge handles. • Place the palm on the jar lid, and using the weight of the body, turn arm at the shoulder to open the jar. A sponge or wet towel under the jar prevents sliding • Hold the knife or mixing spoon like a dagger, with the handle parallel to knuckles. Cutting is then changed from sawing to pulling • Don't carry heavy handbags, pails, and bags by the handle. • Hold everything no tighter than necessary. • Release tight grasp frequently if you must use it. • Use built-up handles on writing utensils, pot handles, tools, etc. • Use adaptive equipment such as jar openers
2. AVOID PRESSURE ON BACK OF KNUCKLES (MP JOINTS)	• Avoid all pressures against the backs of fingers: this type of pressure contributes to dislocation of the large joints between the palm and the fingers (metacarpal-phalangeal joints). • This occurs while pushing up from a chair using a closed fist or resting chin on the backs of fingers. • Use palms while holding fingers straight.
3. USE BOTH HANDS WHEN POSSIBLE	• Not specified how
4. AVOID REPETITIVE HAND ACTIVITIES	• Take breaks • Change activity, *i.e.*, using screwdriver, crocheting
5. AVOID PRESSURE TO TIP OR PAD OF THUMB	• The thumb is necessary for 40 percent of hand activities • Example: opening car doors, ringing doorbells • To protect thumb joints, open milk containers with heels of the hands rather than thumbs.
6. AVOID PRESSURE AGAINST THE RADIAL SIDE OF EACH FINGER THUMB SIDE	• Don't rest chin on the side of fingers. • Add levers to keys, handles, and knobs. • Hold handles straight across the palm.
7. AVOID PROLONGED PERIODS OF HOLDING HANDS IN THE SAME POSITION	• Sit if the task takes more than 10 minutes. • Stand up after sitting for 20-30 minutes. • Reposition yourself often.

Table 5. OASIS-Vancouver Coastal Health. Hand Osteoarthritis - Protecting Your Hands (Grey Literature online material on joint protection).

1. Use your bigger joints to complete a task	• Carry your handbag with your shoulder or forearm. Carry only what you need. • Push or pull items rather than carry them, *e.g.*, use a wheeled cart for groceries • Carry large or heavy items with two hands. Hug the object close to your body. • Close drawers/doors with your hip or choose automatic doors when possible • Push up from a chair using the palm of your hand, not your fingers. Choose higher chairs or use a firm cushion on your chair.
2. Plan ahead	• Vary tasks and change your hand position often. Take breaks every 20-30 minutes. • Spread heavier tasks throughout the week • Rest your hands before they are tired or sore • Organize your workspace to ensure hands and wrists are in a neutral posture
3. Use splints to protect your joints, either at rest or during activity	• Talk to your care team to determine if a hand or thumb splint would be helpful for you

4. Change your grip and use adapted equipment to avoid tight gripping/squeezing and force through the thumb	Writing, gardening ➔ Buy large-handled tools or make your handles larger with foam tubing Cooking ➔ Adapted kitchen aids, *e.g.*, finger vegetable peeler, ergonomic salad spinner Opening jars and cans ➔ Jar seal-opener, non-slip grip, electric can opener Twisting tops, squeezing tubes ➔ Products with pumps Wringing out clothes ➔ Use the heel of your hand; sponge or washing brush Driving ➔ Foam steering wheel cover Pumping gas ➔ Use the lever on the handle to avoid squeezing for a long time Pinching a key ➔ Keyholder Reading ➔ Bookholder, books on tape, e-books Opening mail ➔ Easy-to-squeeze scissors Dressing ➔ Button hook, zipper pull Opening doors, turning taps ➔ Lever taps and door handles Gripping slippery items, *e.g.*, removing credit cards from a wallet ➔ Use a piece of non-slip mat, *e.g.*, Dycem; accordion-style wallet Self-care, *e.g.*, cutting nails, washing hair, etc. ➔ Adapted equipment from a pharmacy or medical supply store
5. Follow the exercises given to you by your health care team to keep your joints moving and your muscles strong	No further instructions were given

Table 6. East Sussex Healthcare NHS. Joint protection techniques for hands (claiming source Arthritis Research UK, www.arthritisresearchuk.org.) (Grey Literature).

1. Use joints in a stable position	• Sit or stand as close as you can when working at a table or bench as this reduces stretching • and bending. • Use a grip that keeps the wrists straight and the fingers in line with the wrist as much as • possible.
2. Avoid activities that do not allow for a change of position	• Be mindful of how long you have been doing specific activities, joint and muscles do not like to be held in the same position. They become stiff and work less effectively which leads to pain, damage and further deformity. When writing, doing hand work, release your grip every 10 to 15 minutes. On long car trips, get out of the car, stretch and move around at least every one to two hours.
3. Respect pain	• If you have arthritis, you may always have some pain. If pain continues for hours after the activity has stopped, this indicates that the event was too much and should have been changed or stopped sooner.
4. Avoid tight grips or gripping for long periods	• Gripping tightly increases pain and can cause further joint damage. Gripping small objects require greater force
5. Avoid deforming positions	• When opening new or tight jars consider using a gripping aid and direct the force through the palm of your hand rather than just through the fingers. There are several types of jar opening devices. Ask others to undo the lids, while you close them. • Use a flat hand when possible for cleaning, wiping, dusting. • Try using cups with larger, straighter handles than cups with curved handles. • In general, finger motions should be in the direction of the thumb whenever possible.
6. Use one large joint or many joints	• Carry objects with your palm open to distribute weight equally over your forearms. • Slide objects along a counter or workbench rather than lifting and carrying them. • Carry light bags on your shoulders rather than with your hands. • When standing up from a chair or bed, rock forward and use your leg muscles rather than pushing up from your knuckles or wrists. • Use your hip or lower leg to close drawers.

6. OUTCOME MEASURES

The outcome measures that were used in the included studies are summarized in Table **2**. Pain was the most evaluated outcome measure and it was evaluated with Visual Analog Scale (VAS) or by pain subscale of Health Assessment Questionnaire (HAQ) or by Numeric Pain Rating Scale (NRS) and by Michigan Hand Questionnaire. Self-report measures for psychological domains were evaluated with the Arthritis Self-Efficacy Scale (ASES), Hospital Anxiety and Depression Scale (HADS), Arthritis Helplessness Index (AHI) and Sense of Coherence (SoC). Disease-specific activity outcome measures were evaluated with the Disease Activity Score 28 (DAS28), Rheumatoid Arthritis Disease Activity Index (RADAI), Arthritis Impact Measurement Scale (AIMS2). Quality of life was assessed with EUROHIS-QOL 8 and health status with SF-12 and EQ-5D-3L. Functional ability was evaluated with HAQ, Dreiser Functional Index (DFI), Australian Canadian Osteoarthritis Index (AUSCAN), and Functional Index for Hand Osteoarthritis (FIHOA). The adherence of joint protection programs was measured with the Joint Protection Behaviour Assessment (JPBA), and joint deformity was assessed with Hand Joint Alignment and Motion Scale. Efficacy was measured with general self-efficacy scale and with global change. Disability was assessed with HAQ and with

Disabilities of the Arm, Shoulder, and Hand (DASH). Performance-based tests were performed to assess grip and pinch strength as well as hand dexterity. Clinician based-outcomes included wrist range of motion and finger range of motion.

7. JOINT PROTECTION APPROACHES

In half of the studies, it was not clear who was primarily involved in delivering the joint protection program. Only two studies reported that the joint protection was provided by medical staff (nurse or physician) and by a research assistant. Joint protection and energy conservation were administered mostly with two methods such as an educational-behavioral approach or as an approach that was focused on personal goals and available resources. The average time of a standardized joint protection education lasted from 1.5 to 3.25 hours approximately over two sessions. The usual content of the joint protection education was to educate the participants about the disease and how the joints are affected by h-OA or RA. The education sessions included information about the joint protection principles with short time demonstrations (15 to 30 minutes) of hand joint protection approaches usually for household activities. At the end of the joint protection education, there was a discussion about patients' needs and problems that were mostly supported by a leaflet. The joint protection tasks are summarized in detail in Table **3**. Assistive devices were not reported in the vast majority of the studies.

8. GREY LITERATURE

Our grey literature search identified several online sources that are [1]: non-profit organizations (*e.g.* National Agricultural Safety Database (NASD), East Sussex Healthcare NHS, OASIS-Vancouver Coastal Health. Hand Osteoarthritis) [68] [2] educational e-learning communities (*e.g.* Physiopedia) [69] that have available online material for joint protection for people with hand arthritis and [3] Thesis from post-graduate and doctoral studies. General joint protection principles for hand consideration included: avoid tight grasp, avoid pressure on back of knuckles, use both hands when possible, avoid repetitive hand activities, avoid stress to tip or pad of thumb, avoid to pressure against the radial side of each finger thumb side, avoid prolonged period of holding hands in the same position, use more prominent joints to complete a task, plan ahead, use orthotic devices to protect your joints and respect pain., and further details are summarized in Tables **4**-**7**.

Table 7. Energy conservation and joint protection from National Agricultural Safety Database (NASD) Grey Literature online material on joint protection.

• Respect **PAIN** as a signal to **STOP** the activity.
• Make a **SCHEDULE** of daily activities. Write down when **PAIN** and **FATIGUE** occur and schedule in **REST BREAKS** as needed.
• Avoid **POSITIONS OF DEFORMITY** and **FORCES** in their direction. Finger motions should be in the direction of the thumb whenever possible. When getting up from a chair or holding a magazine, use the palms of the hands rather than the knuckles.
• Use the **LARGEST** and **STRONGEST** joints available for a job. Save weaker joints for the specific tasks that only they can handle. For example, carry bags on the shoulder instead of at the elbow, wrist, or fingers.
• Avoid staying in **ONE POSITION** for a **LONG PERIOD OF TIME**. Don't give your joints the chance to become stiff. When writing or doing handwork, release your grip every 10 to 15 minutes. On long car trips, get out of the car, stretch and move around at least every hour. While watching television get up and walk around every 30 minutes.
• Use a **CART** to carry heavy items. If no cart is available, it is better to take several trips to get a job done than to overload and make one trip.
• **SLIDE** or **PUSH** items whenever possible.
• Avoid making a **TIGHT FIST** or **PINCHING** objects tightly. Instead, use a grasp that places your **KNUCKLES PARALLEL** to the handle of the tool or utensil being used.
• **DO NOT** start an activity that cannot be **STOPPED IMMEDIATELY** if pain or fatigue should occur.

9. DISCUSSION

This study aimed to summarize the extent of the evidence for joint protection principles for the management of RA / h-OA and identified randomized controlled trials, systematic reviews and overviews of reviews as the primary sources of scientific evidence for the current joint protection programs. Pain, function, psychological domains, adherence, quality of life and health-status were the main outcomes that were administered. More specifically, pain levels were mainly examined by Visual Analog Scale, Health Assessment Questionnaire, Numeric Rating Scale and self-reported psychological domains Arthritis Self-Efficacy Scale, Health Anxiety and Depression Scale, Arthritis Helplessness Index and Self of Coherence. Function was mostly examined by Australian Canadian Osteoarthritis index (AUSCAN), Michigan Hand Questionnaire (MHQ) and Health Assessment Questionnaire (HAQ). While the occupational therapist was primarily responsible for the delivery of joint protection, in half of the included studies, it was unclear who was

mainly involved in delivering the joint protection program. Also, the current joint protection programs primarily focused on tasks associated with home care and kitchen, and the review of the grey literature yielded principles such as avoiding tight grips, awareness of pain, limiting prolonged periods of holding and use of larger joints.

This scoping study did not evaluate the effectiveness of Joint protection programs but identified 18 RCTs that can be synthesized to investigate their effectiveness. The two most recent systematic reviews (26,27) provided recommendations from 8 RCTs in total leading to the exclusion of 10 additional trials. Therefore, an update of the most recent evidence is highly recommended.

Joint protection as a multimodal intervention includes the following components [1] altering working methods [2], use of proper joint and body mechanics through applying ergonomic principles [3], use of assistive devices, and [4] modifying functional performance and environments [54]. It is often integrated with fatigue management, working splints and flexibility and strengthening exercises [54]. We were unable to extract all the components mentioned above of joint protection because either there was a lack of reporting or either the joint protection intervention was not fully implemented. Joint protection programs may include specific principles and techniques such as avoiding tight grips or use of larger joints or utilize particular exercises or energy conservation methods. Therefore, it is crucial to ensure comprehensive reporting of all the components of such programs when used in clinical studies. In this review, we were unable to extract specific information on what exactly included in joint protection programs from most of the clinical studies because the information was not available.

Future research needs to focus on clear and concise reporting of different principles included in joint protection programs utilized in clinical studies and ensure adequate representation of men and women. It is crucial to assess the effectiveness of such joint protection programs in large-scaled well-designed randomized controlled trials by incorporating all the components of joint protection and not only parts of joint protection.

The strengths of this review are that we summarized all the reported joint protection principles in peer-reviewed and grey literature. We highlighted the main outcome measures that were used in most of the studies to help future clinical studies to select the most commonly used self-report outcome measures and performance-based tests. We identified a lack of clarity and lack of detailed description on the components of joint protection that were tested. Finally, we indicated that many RCTs (n=10) have been published that have not been considered in a recent evidence synthesis.

Despite the authors' efforts to follow rigorous guidelines from Arksey and O'Malley (7), this scoping study is subjected to several limitations. A thorough literature search was performed; however, we may have missed research articles that were under development during the study period. Also, a search of the grey literature was conducted through google search web engine, but we have decided to stop after the first ten pages of google web. Therefore, online material that addresses joint protection strategies may have been missed during the search process.

CONCLUSION

This review synthesized and critically examined the scope of joint protection programs for management of h-OA and found that RCTs, systematic reviews and overviews of reviews constituted two-thirds of the current body of literature. Furthermore, it identified a lack of clarity regarding the specific elements of joint protection programs used in studies.

KEY MESSAGES

- An occupational therapist mainly delivers joint protection.
- Pain levels (VAS, HAQ, NRS), self-reported psychological domains (ASES, HADS, AHI, SoC) and function levels (AUSCAN, HAQ, MHQ) were identified as the main outcomes that were administered.
- Lack of detailed reporting for the components of joint protection programs.

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CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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